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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,500	11/12/2003	Ya-Lun Cheng	82546	4755

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EXAMINER

MALSAWMA, LALRINFAMKIM HMAR

ART UNIT PAPER NUMBER

2823

DATE MAILED: 04/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

10/705,500

Applicant(s)

CHENG ET AL.

Examiner

Lex Malsawma

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-5,8,9,19,20 and 22-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1,3-5,8,9 and 19 is/are allowed.
- 6) ☒ Claim(s) 20 and 22-25 is/are rejected.
- 7) ☒ Claim(s) 26 and 27 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114.

Applicant's submission filed on February 28, 2005 has been entered.

Claim Objections

2. Claim 20 is objected to because of the following informalities:

In line 8, before "silicon oxide", "comprises" should read "comprising"; and
in line 10, before "silicon nitride", "comprises" should read "comprising."

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 20, 22, 23 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (6,087,235) in view of Deckert et al. (4,269,654; hereinafter, "**Deckert**").

Regarding claims 20, 23 and 25:

Yu discloses (in Figs. 4-6 and Col. 2, lines 35-61) a method that prevents formation of a spacer undercut in SEG pre-clean process, comprising:

providing a semiconductor substrate 102;

forming a gate structure 204 on said semiconductor substrate, wherein said gate structure comprises a gate oxide 202 and a polysilicon gate electrode 204 which is formed on said gate oxide 202 (note that Yu discloses that gate electrode 204 would typically comprise polysilicon, Col. 3, lines 49-50, Col. 1, lines 55-56 and Col. 5, lines 6-8);

forming a first spacer comprising silicon dioxide 212 on a side-wall of said polysilicon gate electrode 204 and said gate oxide 202;

forming a second spacer comprising silicon nitride 210 on a side-wall of said first spacer;
and

forming a raised source/drain (214, 216) by selective epitaxial growth (SEG) of silicon on the surface of the semiconductor substrate (Col. 2, lines 46-54).

Yu **lacks** specifying a process for acquiring the double sidewall structure (212, 210), wherein the process does not leave an undercut as shown in Fig. 5, i.e., Yu does not disclose using HFEG solution to clean portions of the surface of the substrate, the first spacer and the second spacer.

Deckert **teaches** a process for etching a composite structure comprising silicon nitride and silicon oxide, wherein the etching is performed with an etching solution comprising HF diluted by ethylene glycol (HFEG) such that the silicon nitride can be etched faster than (or equally as fast as) the silicon oxide (note abstract, Col. 2, lines 17-24, Col. 3, lines 4-12, and Col. 5, lines 31-33). Note that Deckert discloses that prior etching processes can leave undercuts because silicon oxide is etched much faster than silicon nitride (Col. 1, lines 35-49, note especially, line 48); and in the prior art, Deckert discloses it required a three-step etching process to obtain a desired geometric configuration (note Col. 1, lines 56-68).

Since Yu does not specify how the double spacer structure is formed without an undercut (as shown in Figs. 5-6), it would have been obvious to one of ordinary skill in the art modify Yu by utilizing an etching process/solution taught by Deckert because the HFEG solution would etch the silicon nitride (i.e., the second spacer) faster than the silicon oxide (i.e., the first spacer) such that an undercut will be prevented (as shown in Figs. 5-6 of Yu). Furthermore, utilizing Deckert's process to form Yu's double spacer structure would result in cleaning portions of the substrate, the first spacer and the second spacer with the HFEG, since portions of these three regions/elements will be exposed to the HFEG solution during the process for forming the double sidewall.

Regarding claim 22:

Deckert discloses an HFEG solution prepared by adding 68 ml of hydrofluoric acid (HF) to ethylene glycol to make 1 liter, i.e., a volume ratio being within 0-4%.

6. Claim 24 rejected under 35 U.S.C. 103(a) as being unpatentable over **Yu** (in view of **Deckert**) as applied to claim 23 above, and further in view of Lee et al. (6,261,911 B1; hereinafter, "**Lee**").

Regarding claim 24:

Yu (in view of Deckert) does not specify a process used for the selective epitaxial growth (SEG); however, note Yu specifies (in Col. 5, lines 60-63) that fabrication processes for SEG are known to one of ordinary skill in the art. Lee is **cited only to show** it was very well known in the art to utilize either low-pressure CVD (LPCVD) or ultra-high-vacuum CVD (UHVCVD) for an SEG process (note the sentence bridging Cols. 3-4). It would have been obvious to one of ordinary skill in the art to modify Yu (in view of Deckert) by specifically reciting the use of LPCVD or UHVCVD for the SEG process because Lee shows these are well known methods for SEG and Yu specifically discloses using well-known methods for the SEG process.

Allowable Subject Matter

7. Claims 1, 3-5, 8, 9 and 19 and 10-14 are allowable over the references of record for reasons provided in a prior Office Action.

8. Claims 26 and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter:

Claims 26 and 27 would be allowable primarily because claim 26 requires another pre-clean process utilizing DHF (i.e., DHF is defined in the specification as hydrofluoric acid diluted in deionized water), wherein the two pre-cleaning processes using a combination of DHF and HFEG prevent a spacer undercut from forming. The cited references (especially Deckert) are drawn to a process using (only) HFEG to replace prior multiple-etching processes, where using HFEG alone provides the desired geometric configuration (e.g., prevents spacer undercutting).

Remarks

10. Applicant's remarks have been fully considered and claims 26 and 27 have been indicated as containing allowable subject matter. However, the application in not in condition for allowance because of the rejections under 35 USC § 103 presented in detailed above.


Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lex Malsawma whose telephone number is 571-272-1903.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Lex Malsawma 

April 16, 2005